Soil Flooding during the Off-season as an Alternative to Methyl Bromide

L.H. Allen, Jr.[1], D. R. Sotomayor[1], D.W. Dickson[2], and Z. Chen[2]

[1] USDA, Agricultural Research Service, University of Florida
Gainesville, FL 32611 USA

[2] Entomology and Nematology Department, University of Florida
Gainesville, FL 32611 USA

Vegetable crops in Florida are often grown on high water table soils that must be drained to facilitate crop production. Furthermore, parasitic nematodes, weeds (especially purple nutsedge), and plant pathogens must be controlled for successful- production. Soil water-logging has been shown to control nematodes in organic soils; less information is available for mineral soils. The heavy rainfalls typical during the summertime off-season offers the opportunity to flood fields and create anoxic soil environment as a possible management practice as an alternative to methyl bromide.

Experiments were undertaken in 1.2 m^2 microplots in 1996 to determine the potential of soil flooding, in combination with compost, clear plastic solarization, and rice culture, on the control of root-knot nematode *(Meloidogyne arenaria)* and purple nutsedge *(Cyperus rotundus* L.) in mineral soil. Redox potentials were measured to determine the effectiveness and time course of flooding for creating anoxia in the soil. The 14 soil management and flooding treatments (four replications) were presented by Sotomayor and Allen (1996) and are also listed in Table 1.

Soils of all microplots were prepared in June 1995 (compost vs. no compost), colonized with purple nutsedge in August 1995, and inoculated with root-knot nematode in May 1996 prior to treatment initiation. Three eggplants were transplanted into the microplots in May 1996 to provide a host for nematode colonization and soil infestation. The aboveground parts of the eggplants were removed on 30 July 1996, and clear-plastic solarization and flooding treatments begun on 2 August 1996. Intermittent flooding treatments FLOOD(1) were flooded for 5 weeks, drained for 2 weeks and then reflooded for another 5 weeks. Continuously flooded treatments FLOOD(C) were maintained for 12 weeks. Eighteen rice plants (cv. Lamont) were transplanted into selected microplots (flooded vs. nonflooded and composted vs. noncomposted) on 9 August 1996.

Differences in treatment effects on purple nutsedge tended to disappear after regrowth in the 14 treatments in 1997. Treatments have been continued in the summer of 1997, and responses of both root-knot nematodes and purple nutsedge will be reported also.

A depth of flooding experiment was begun on 4 October 1996 after establishing purple nutsedge at three ages beginning on 19 September. This experiment is being repeated in 1997 also.

Flooding appeared to be effective in controlling root-knot nematodes, based on both counts of juveniles in the soil after 12 weeks of flooding and the number of galls produced on bioassay tomato roots (Table 1). Nonflooded rice appears to harbor root-knot nematode, but theses plots were also had the highest infestation of all weeds.

Another experiment was conducted on the effects of various types of anaerobic and aerobic conditions on survival of second stage juveniles of root-knot nematodes with incubation times from 1 to 4 weeks (Table 2). These treatments are far different from soil conditions, but the results show that essentially no nematodes survived after two weeks of anaerobic conditions.

Table 1. Final root-knot nematode juvenile population after 12 weeks flooding of microplots.

Treat	Treatment	# of root-knot juveniles per 100 cm^3 Soil		# of galls on bioassay tomato roots	
2	NONFLOOD, RICE, NONCOMPOST, NONSOLARIZE	263	a	161	a
9	NONFLOOD, RICE, COMPOST, NONSOLARIZE	258	a	144	a
8	NONFLOOD, FALLOW,COMPOST, NONSOLARIZE	53	bc	39	b
13	NONFLOOD, FALLOW, NONCOMPOST,SOLARIZE	14	c	24	b
10	FLOOD(C), RICE, COMPOST, NONSOLARIZE	134	b	20	b
12	FLOOD(C), FALLOW, COMPOST,NONSOLARIZE	15	c	10	b
3	FLOOD(C), RICE, NONCOMPOST,NONSOLARIZE	28	c	7	b
1	NONFLOOD, FALLOW, NONCOMPOST,NONSOLARIZE	59	bc	5	b
14	NONFLOOD, FALLOW, COMPOST,SOLARIZE	5	c	5	b
11	FLOOD(I), FALLOW, COMPOST,NONSOLARIZE	21	c	1	b
12	FLOOD(C), FALLOW, COMPOST,NONSOLARIZE	15	c	0	b
5	FLOOD(C), FALLOW, NONCOMPOST,NONSOLARIZE	11	c	0	b
4	FLOOD(l), FALLOW, NONCOMPOST,NONSOLARIZE.	6	c	0	b
7	FLOOD(C), FALLOW, NONCOMPOST,SOLARIZE	7	c	0	b
6	FLOOD(l), FALLOW, NONCOMPOST,SOLARIZE	14	c	0	b

Means followed by the same letters within columns are not significantly different ($p<0.05$) by the Duncan's multiple range test.

Table 2. Second-stage juvenile root-knot nematode survival in laboratory conditions in 5-ml Vacutainers as affected by treatment and incubation time, beginning with an initial population of 406 nematodes per sample

Treatment	Incubation time (weeks)			
	1.	2	3	4
Aerobic water	135	104	34	18
Aerobic soil	74	69	34	17
Anaerobic water	32	32	28	30
Aerobic waterlogged soil	14	1	1	1
Anaerobic soil	39	<1	<1	<1
Anaerobic waterlogged soil	7	2	2	3

Statistics not calculated yet.